SET OF GOLF CLUBS

Technical field

The invention relates to the field of golf. It relates more specifically to heads of golf clubs of the "iron" type. It is aimed more specifically at irons which have a rear cavity, the geometry of which optimizes the distribution of mass while at the same time maintaining excellent striking qualities.

Prior art

In general, golf clubs in which the head is made of cast or forged metal are known as "irons". Iron heads all have a flat striking face, the inclination of which varies with the number of the iron in the set. Thus, irons with low numbers, that is to say from 1 to 4, also known as "long irons" have a striking face which is not as inclined with respect to the vertical as irons known as "short irons", which have a high number in the set, that is to say 8, 9 and PW.

One of the objectives in improving the tolerance of an iron consists in distributing the weight of the head at the perimeter, around the center of the striking face. The center of the striking face, corresponding to the ideal zone of impact, also known as the "sweet spot" is wider, the more the weight is distributed around the perimeter.

This is why a certain number of clubs have already been proposed in which the head has a rear cavity delimited by walls extending backward behind the striking face. This cavity can also, as a side issue, accommodate various decorative or functional elements.

Amongst the walls delimiting the rear cavity, the lower wall forms what is generally known as the "sole", the lower face of which faces the ground at the time of the strike. The cavity is also delimited by an upper wall that the golfer has in his field of view when he prepares the hit and strikes the ball. The cavity is also delimited by two lateral walls, the

first being situated on the side of the head connecting to the shaft, also known as the "heel", the second wall being situated on the opposite side, generally known as the "toe". The set of walls delimiting the cavity is generally known as the "perimeter".

The peripheral shape of the perimeter distributes some of the mass of the head at the perimeter, thus widening the "sweet spot" and increasing the tolerance of accuracy.

It has already been proposed for the perimeter to be given special shapes intended to improve the mass distribution still further, particularly by increasing the mass of the lower wall that forms the sole, and as a counterpart, by reducing the mass of the upper wall. Thus, document US 5 048 834 describes a golf club which has a rear cavity, in which the lower wall of the perimeter has a protuberance directed toward the interior of the cavity, and which therefore increases the mass of the bottom part of the head. This solution increases the weight of the bottom part of the head, but has the disadvantage of stiffening the central zone of the striking face and therefore of reducing the "sweet spot" and therefore of providing results which are merely mediocre in terms of tolerance.

It has also been proposed, in document US 5 437 456, for the walls of the perimeter to be hollowed out to the rear of the striking face, at the zone where they meet the bottom of the cavity. This solution decreases the mass of the head in the immediate vicinity of the striking face and offsets some of this mass further toward the rear of the striking face. The head described in that document also comprises slots opening onto the upper and lower surfaces of the head. These slots produce a marked separation between the upper, lower and lateral walls. This solution has the disadvantage of weakening the perimeter through the presence of these slots. The rear walls thus separated also have a greater tendency to vibrate, which may constitute an impediment for the

golfer. In addition; the slots located on the upper face of the head are visible to the golfer, and are a visual annoyance to him.

The objective of the invention is to provide a golf club head which simultaneously makes it possible to distribute the mass within the perimeter with preference to the lower wall forming the sole, while at the same time maintaining a good width of sweet spot in order to ensure good tolerance. It is also important that such a distribution is optimized for each club of a set.

Summary of the invention

The invention therefore relates to a set of golf clubs of the "iron" type, the rear face of the head of each club has a cavity delimited by walls, namely at least one lower wall forming the sole and an upper wall.

The upper wall has several faces, namely a rear face, an upper face, a lower face facing the cavity and lateral faces.

According to the invention, several golf clubs of the set has a head which has at least one recess made in the upper wall and opening onto a single face of said upper wall, away from the upper and lower faces.

In other words, the upper wall delimiting the cavity is hollowed out to reduce the weight of this upper part. In consequence, the distribution of mass within the perimeter privileges the lower wall. By opening onto a single wall, the characteristic recesses do not weaken the perimeter.

The recesses made in the upper wall may open at various points, except for the upper face, this being so as not to be visible in the field of view of the golfer, so as not to disturb him as he prepares and makes the hit.

Thus, the characteristic recess or recesses may open either onto the rear face of the upper wall or

alternatively onto a lateral face of this wall, that is to say onto the lateral face of the head.

In other words, the opening of these recesses is located either at the rear of the head or on one of these lateral sides.

If the recess opens onto a lateral face of the head, it will be preferable, for manufacturing reasons, for this to be the lateral face on the toe side of the head.

The characteristic recesses may adopt highly varying shapes, if they open onto a single face of the upper wall. Thus, the recess may be elongate in the main direction of the upper wall. In other words, in the case of recesses opening onto the rear face of the upper wall, the opening of the recess has a longer dimension which is more or less parallel to the upper wall, or which follows its slight curvature when the latter wall is not straight.

When the recess is produced in such a way that it opens onto a lateral face of the club head, it is then hollowed into the actual thickness of the wall, parallel to the upper and lower faces of the upper wall, and also parallel to the striking face.

In one particular embodiment, the recess may be cylindrical, whether this be when it opens onto the rear face of the upper wall or onto a lateral wall thereof. In this case, it may, for example, be achieved by machining by milling, drilling, or alternatively directly by injection.

In order to prevent the recess from becoming filled with earth or any other material that would alter the distribution of mass, it will be preferable for the recess to be filled with a low-density material, such as a polyurethane foam for example, so as to prevent the intrusion of foreign bodies. The filled material is chosen so that it has only an imperceptible effect on the mass distribution.

Advantageously in practice, the volume of the recess represents between 0.4% and 5% of the volume of

the head. The volume of the recess is to be understood as meaning the volume of material that would need to be introduced into the recesses for the upper wall to have a uniform external shape. This corresponds to the volume removed from the upper wall and transferred to the lower wall so as to lower the center of gravity of the head.

For playing golf, a golfer has a set of irons of different characteristics. There are generally long irons, carrying a number from 1 to 4, intended for long-distance hitting, intermediate irons numbered from 5 to 7, and short irons numbered 8, 9 and PW intended for precision shots.

According to the invention, the volume of the recess(es) and/or their position inside the upper wall is variable within the set, so that the position of the center of gravity of the head varies from one club to another. These geometrical characteristics vary in the same sense within the set.

Thus, in a particularly advantageous embodiment, the distance separating the recess or recesses from the hosel may increase or decrease with the club number. The distance between the recesses and the hosel is to be understood as meaning the distance from the barycenter (or center of gravity) of the recess or of the set or recesses to the axis of the shaft.

Thus, in a first set, this distance increases with the club number. In other words, the distance separating the club shaft from the characteristic recess increases from long irons to short irons. By virtue of this progression, and for a constant recess volume, the shortest irons have a lower moment of inertia with respect to the axis of the shaft.

Conversely, in another set, this distance may decrease with the club number. In other words, the distance separating the shaft of the club from the characteristic recess increases from long irons to short irons. By virtue of this increase, and for a

constant recess volume, the longest irons have a center of gravity which is lowered by comparison with the short irons, because of the upward inclination, from the hosel, of the upper wall of the head.

In another alternative form of embodiment, the volume of all the recesses may increase or decrease with the club number. In other words, the total volume of the recesses varies between long irons and short irons. The variation in this volume may be achieved in particular by varying the depth of the recesses or alternatively by increasing their aperture on the face of the wall onto which they open.

If the recess is transversal and opens onto a lateral face of the head, this recess may have a greater or lesser depth.

In another alternative form regarding the progressiveness of the effect of the characteristic recesses, these may decrease in number with the club number in the set. In other words, the number of recesses decreases from long irons to short irons.

In another alternative, the distance separating the recess or recesses from the upper face of the upper wall varies from one club to another. In other words, the recesses may be located at different height within the upper wall, in order to modify the position of the center of gravity of the head.

Brief description of the figures

The way in which the invention is achieved and the advantages that stem therefrom will become clearly apparent from the description of the embodiments which follow, in support of the appended figures, in which:

figure 1 is a view from the rear of a golf club head according to a first form of embodiment.

Figure 2 is a view in section of figure 1 on the plane II-II'.

Figure 3 is a view from above of the head of figure 1.

Figure 4 is a view from the rear of a head produced according to a second form of embodiment.

Figure 5 is a view from the rear of a head produced according to a third form of embodiment.

Figure 6 is a view from the right-hand side of figure 5.

Figure 7 is a view from above of figure 5.

Figures 8a, 8b and 8c are views from the rear of three heads of one and the same set of clubs, having different numbers.

Figures 9a, 9b and 9c are rear views of three heads belonging to a second set of clubs.

Figures 10a, 10b and 10c are a rear view of three heads belonging to a third set of clubs according to the invention.

<u>Embodiment of the invention</u>

As already stated, the invention relates to a head of a golf club of the "iron" type. In general, and as illustrated in figures 1 and 2, such a head (1) comprises a hosel (2) intended to be connected to the shaft, and a striking face (3) which makes impact with the ball.

In its rear part, the head (1) comprises a cavity (4), the bottom (5) of which is behind the striking face (3). This cavity (4) is delimited laterally by a perimeter (6) consisting of various walls.

More specifically, this perimeter (6) comprises a lower wall (7) forming the sole of the head and the lower face (8) of which faces the ground at the moment of impact. The perimeter (6) also comprises two lateral walls (9, 10), the inner faces (11, 12) of which face toward the cavity (4). The perimeter (6) also comprises an upper wall (13). This upper wall (13) comprises several faces, namely:

- an upper face (14) situated in the field of view of the golfer when he strikes the ball,

- a lower face (15) directed toward the cavity (4),
- a rear face (16) roughly parallel to the striking face and directed toward the rear of the head,
- lateral faces (17, 18) situated at the boundary with the lateral walls (9, 10).

The upper wall (13) has one or more recesses hollowed into its thickness.

In the form illustrated in figures 1 to 3, these recesses (20-23) open onto the rear face (16) of the upper wall (13). These recesses (20-23) have an elongate shape, in the direction of the long dimension of the upper wall (13), that is to say in a roughly horizontal direction.

As illustrated in figure 1, one recess (21) has a width l in the main direction of the upper wall (13) and a height h measured at right angles to this direction.

The walls (25, 26) of the recess (21), lying facing one another, are roughly parallel, or adopt a similar curvature. The overall shape of the opening of the recess (20-23) may be rectangular, trapezoidal or, more generally, may have slightly rounded ends, depending on the tools or mold used to make them.

As illustrated in figure 2, each recess (20-23) is hollowed inside the upper wall (13) to a depth p which may represent 10 to 90% of the thickness e of the wall in the zone in question. The combination of the three parameters: width l, height h and depth p, roughly determines the volume of the recess. Depending on the amount of material that it is desirable to remove, this volume can be adjusted by varying each of these parameters l, h and p.

The position and dimensions of each of these recesses (20-23) can be adapted to optimize the lightening of weight of the upper wall (13) with a view to altering the distribution of mass within the perimeter (6). Thus, for a total head weight of between

200 and 300 grams, the amount of material removed to form all the recesses is of the order of 0.8 to 2 grams.

Of course, the invention is not restricted to the sole embodiment illustrated in figures 1 to 3 in which the number of recesses is four, but covers alternative forms in which this number varies from one to more than ten.

Nor is the shape of the recesses restricted to this shape illustrated in figure 1; on the contrary, it also covers the alternative forme illustrated in figure 4 in which the recesses (30) are roughly cylindrical, and for example made by drilling.

The diameter Ø and number of these recesses (30) can be adapted to suit the amount of material that needs to be removed from the upper wall (13). Of course, the opening of each recess may adopt other shapes such as elliptical, conical or other.

Thus, the recesses made in this way in the upper wall (13) reduce its mass and modify the position of the center of gravity with respect to the axis (19) of the shaft and/or with respect to the base (8) of the sole (7). This results in a variation in the inertia with respect to the axis of the shaft, which gives rise to an increase in the power of the hit. It is also found that the trajectory improves with the variation in height of the center of gravity.

As already stated, the characteristic recesses may be produced according to other forms of embodiment such as those illustrated in figures 5 to 7. Thus, the recess (33) illustrated in figure 5 opens laterally onto the lateral face (17) of the upper wall (13). Specifically, the opening (34) of the recess (33) is circular when viewed along the axis (35) of the recess. This recess (33) may be produced by drilling or milling. It is advantageously cylindrical for manufacturing reasons, but could just as easily adopt a different shape.

The influence of the recess (33) can be altered by changing its volume and therefore the amount of material removed from the upper wall (13). More specifically, the volume of the recess (33) depends essentially on its length L and on the area of its opening (34), that is to say on its diameter. The position of the recess (33) within the upper wall can also be altered slightly. Thus, this recess (33) may be closer to or further from the striking face (3) and the lower face (15) of the upper wall (13).

By increasing the length L of the recess (33), the mass of the upper wall (13) is reduced and the center of gravity of the head is correspondingly lowered. Similarly by increasing the length L, the moment of inertia of the head with respect to the axis of the shaft is reduced.

In practice, the length of the recess (33) may be between 10 and 90% of the total length of the upper wall (13). Its diameter is of the order of 3 millimeters.

As already stated, the characteristic recesses differ from one club to another within the same set.

Thus, and as illustrated in figures 8a, 8b and 8c, the number of recesses may vary within the actual set. Thus, the head (40) corresponding to a long number 2 iron, has five recesses (41-45) made in its upper wall (13). It will be noted in passing that these various recesses have different lengths.

The intermediate club is such that the number 5 club (46) illustrated in figure 8b has just three recesses (47, 48, 49). These recesses (47-49) may be identical to the recesses (41, 42, 43) of the number 2 club, but may also differ from this number.

The barycenter of the three recesses (47, 48, 49) is roughly in the same position with respect to the upper wall (13) as the barycenter of the recesses (41-45) of the number 2 club (40) in figure 8a. In other words, the impact of reducing the number of recesses from the number 2 iron to the number 5 iron

results only in a shift of the center or gravity (G40, G46) upward, in a roughly vertical direction. The centers of gravity (G46, G40) illustrated in figure 8b are not depicted precisely, but simply by way of illustration.

In the same way, the number 9 club (50) illustrated in figure 8c has just one recess (51). This recess (51) has a barycenter which is in the same position with respect to the upper wall (13) as the barycenters of the recesses of the number 2 (40) and number 5 (46) clubs. Thus, the center of gravity (G50) of the number 9 head is shifted roughly vertically with respect to the centers of gravity G46 and G40 of the clubs (40, 46).

Of course, the shapes and sizes of the various recesses (41-45; 47-49, 51) may vary differently from one club to another in the same set or alternatively may be roughly the same for certain clubs with consecutive numbers.

Figures 9a, 9b and 9c illustrate another form of embodiment of a set of clubs. Thus, the club (53) illustrated in figure 9a is a long iron, such as a number 2 iron. It has a recess (54) located somewhat toward the heel of the head. The distance separating the axis of the shaft (55) from the barycenter (56) of the recess (54) is termed d2.

The intermediate number 5 iron, the head (57) of which is illustrated in figure 9b, also has a recess (58) of identical volume to the recess (54) of the number 2 club. The distance d5 separating the center of gravity (59) of this recess from the axis (55) of the shaft is greater than the distance d2 calculated for the number 2 club. It then follows that the center of gravity G57 of the head (57) is closer to the axis of the shaft (55) than the center of gravity G53 of the number 2 club. In addition, the shift of this center of gravity is upward, because, owing to the inclination of the upper wall (13), the recess (58) is higher up than the recess (54).

In the same way, the number 9 club, the head (60) of which is illustrated in figure 9c, has a recess (61) with the same volume as the recesses (56, 58) of the number 2 and number 5 irons. The distance d9 separating the barycenter (62) of this recess (61) from the axis (55) is greater than the distance d5 measured on the number 5 club. It then follows that the center of gravity G60 of the head of the number 9 club is shifted horizontally toward the heel by comparison with the center of gravity G57 and G53.

Another way of varying the position of the center of gravity of the various clubs within a set is illustrated in figures 10a to 10c. More specifically, the head of the number 2 iron (65) has five recesses (66-70) distributed over the entirety of the upper wall (13) of the head (65). By comparison, the head (71) of the number 5 club also has five recesses (72-76), also distributed along the upper wall (13). Each of these recesses (72-76) has a volume slightly smaller than the corresponding recesses (66-70) of the head (65). In consequence, the overall volume of all the recesses is less in the number 5 iron than it is in the number 2 iron. It then follows that the center of gravity G65 of the head of the number 2 club is located below the center of gravity G71 of the number 5 club.

In the same way, the head (77) of the number 2 club has five recesses (78-82) which are also distributed along the length of the upper wall (13). Each of these recesses (78-82) has a volume smaller than the recesses of the lower-numbered clubs, which results in higher positions of the center of gravity G77 with respect to the center of gravity G71, G65 of the lower-numbered clubs.

Of course, the various methods of varying the number, the position and the volume of each of the recesses can be combined within one and the same set in order to optimize the variation in the center of gravity of each head.

It is apparent from the foregoing that the club heads according to the invention have the advantage of allowing a distribution of the mass of the perimeter of the head adapted for each club of the same set in order to optimize its performance, while at the same time maintaining adequate head rigidity.

The way in which this distribution of mass is optimized can be varied in various ways within one and the same set in order to optimize the performance of each iron.